REMARKS

The present invention is a method of active seismic monitoring of an underground formation providing separation or discrimination of induced microseismicity signals from seismic signals emitted during active seismic monitoring of an underground zone under development. The induced microseismicity signals and the seismic signals are preferably obtained only during the active seismic monitoring. The method includes carrying out seismic recording cycles with emission of seismic waves in the formation by coupling therewith at least one seismic source, which emits simultaneously orthogonal signals so as to form a composite vibrational signal, receiving signals reflected by the formation in response to the emission of seismic waves, recording the signals received by at least one seismic pickup and processing the recorded signals to separate respective contributions of each seismic source to the received signals and to reconstruct seismograms equivalent to seismograms that would be obtained by separately actuating each seismic source, separating the induced microseismicity signals in the records from seismic signals resulting from active monitoring operations, by isolating a contribution thereof by comparison with a current spectral model, the current spectral model being formed by updating a previous spectral model using a weighted average of current and previous contributions of each seismic source and by reconstructing the microseismicity signals by inversion in the time domain. See, for example, paragraphs [0017], [0018] and [0047] regarding the use of current and previous spectral models.

Claims 11-20 stand rejected under 35 U.S.C. §103 as being unpatentable over United States Patent 6,442,489 (Gendelman et al) in view of United States Patent 5,721,710 (Sallas). These grounds of rejection are traversed with respect to independent claims 11 and 17 for the following reasons.

Gendelman et al operates in a fundamentally different manner than the method of claims 11 and 17 who utilize the spectral characteristics of the earth's microseismic noise as an information signal which is recorded before the generation of seismic vibrations, as well as during the generation of seismic vibrations. See column 3, lines 32-47, and further, column 4, lines 40-54. In this regard, claims 11 and 17 recite "active seismic monitoring of an underground zone under development, the induced microseismicity signals and the seismic signals being obtained only during the active seismic monitoring (emphasis added)" which excludes the aforementioned operation of Gendelman et al who also obtain microseismicity signals before active monitoring.

Moreover, claims 11 and 17 recite "isolating a contribution thereof by comparison with a current spectral model, the current spectral model being formed by updating a previous spectral model by means of a weighted average of current and previous contributions of each seismic source". It is submitted there is no counterpart of this subject matter in Gendelman et al.

Finally, claims 11 and 17 recite "carrying out seismic recording cycles with emission of seismic waves in the formation by coupling therewith at least one seismic source, which emits simultaneously orthogonal signals so as to form a composite vibrational signal". It is noted that the Examiner has relied

upon Sallas et al for teaching this subject matter. However, it is submitted that Sallas et al, contrary to the Examiner's construction of Sallas et al, do not teach the claimed orthogonal signals. It is noted that the Examiner is relying on the Abstract, column 4, lines 35 to column 5, line 15 and columns 11 and 12. It is submitted that the aforementioned referenced areas of Sallas et al do not teach the simultaneous emission of orthogonal signals so as to form a composite vibrational signal. It is requested the Examiner clarify on the record where he is interpreting the aforementioned orthogonal signals to be present.

For purposes of the record, it should be noted that orthogonal signals would be exemplified, for example, by sine θ and cosine θ with it being understood that the angle θ between the sine and cosine functions is 90° making these signals a classic example of orthogonal signals. If the Examiner has an interpretation of orthogonal signals which differs from the foregoing, it is requested that he point it out on the record. Moreover, if he considers the referenced portions of Sallas et al to disclose orthogonal signals in the nature of sin θ and cosine θ, it is requested that he point out where this is on the record.

Therefore, if the proposed combination were made, the subject matter of the claimed invention would not be obtained since in claims 11 and 17, the recitation of the "microseismicity signals and the seismic signals being obtained only during the active seismic monitoring (emphasis added)", "at least one seismic source, which, emits simultaneously orthogonal signals so as to form a composite vibrational signal" and "a current spectral model,

the current spectral model being formed by updating a previous spectral model using an average of current in previous contributions of each seismic source" has no counterpart in either of Gendelman et al or Sallas et al. Therefore, the subject matter of claims 11 and 17 and the claims dependent thereon would not be achieved if the proposed combination was not made.

In view of the foregoing amendments and remarks, it is submitted that each of the claims in the application is in condition for allowance. Accordingly, early allowance thereof is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (612.44921X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

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Attachments

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